PATENT SPECIFICATION

885,485

DRAWINGS ATTACHED.

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International Classification :—B05. A24c. F06c.

COMPLETE SPECIFICATION.

Improvements in the Manufacture of Ceramic Industrial Articles.

We, FREDERICK DAVID DAVIES, a British Subject, and MOLINS MACHINE COMPANY LIMITED, a British Company, both of 2 Evelyn Street, Deptford, London, S.E.8, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

This invention concerns improvements in the manufacture of industrial articles made of refractory materials specified later. Industrial articles of this kind are frequently referred to as being made of industrial ceramic material.

Articles made of these materials have been used for many years for machine parts where hardness and resistance to wear is desired. Such articles are made of refractory materials which are basically of an abrasive nature, the principal material being aluminium oxide (Al_2O_3) but other materials mentioned hereafter are of a similar nature in this respect.

In earlier times these articles were made of powdered material moulded and bonded together under heat and pressure but while such articles were effective for their purpose they were rather brittle and required properly supporting by elaborate and expensive supports.

In recent years it has been possible to make articles of this nature equivalent in their performance to the moulded industrial articles by a process of spraying refractory material on to metal bodies, for example, steel bodies, thus producing a composite article. This process provides strong and satisfactory articles suitable for instance for spindles, bushes and guides, but although the surfaces can be worked to a great degree of perfection they are, nevertheless, as stated, fundamentally abrasive. Moreover, with the sprayed articles there is a marked tendency for the refractory material to chip or break away at corners or places where it is liable to shock.

It is an object of the invention to provide such articles, hereafter called "industrial articles of the kind referred to", which have a less abrasive surface and in which the tendency to chipping or breaking is substantially reduced.

According to the invention industrial articles of the kind referred to are made by spraying refractory material, as specified below, on to a metal body and after the surface of the material has undergone any necessary mechanical finishing operations it is subjected to a surface treatment by applying an epoxy resin specified below to its surface to render the surface smooth, and to reinforce the refractory material so as to reduce its liability to chipping or breakage. The resin is a solid epoxy adhesive resin consisting of a resinous condensation product of 4 : 4¹-dihydroxydiphenyl - dimethyl - methane and epichlorohydrin, which is solid at room temperature and is admixed with dicyandiamide in the proportion of 4—6 parts of the latter to 100 parts of the resin.

Where the body is of a metal which is liable to decay in the presence of the sprayed refractory (for example ferrous bodies rust), the metal may be plated or coated in any known way with a metal which is immune from such decay.

For ferrous bodies a nickel coat is suitable and conveniently this is sprayed on, because the same gun can be used for spraying the refractory material, and the general conditions and requirements, e.g. spraying booths, safety measures and so on are similar.

[*Price 4s. 6d.*]

In British Patent Specification No. 767,564 it has been proposed to use various resins, including epichlorohydrin resin in the coating of metal surfaces with stoving enamels and in British Patent Specification No. 771,031 similar resins have been proposed for use in coating metal supports to provide machine bearings.

The invention will be further described with reference to the accompanying drawings which illustrate the manufacture of an article by the spraying process where the refractory material is sprayed on to a body of steel or other ferrous metal.

In the drawings: —

Figure 1 is a section of a roller having a refractory coating on its periphery;

Figure 2 represents a set-up applicable, with variations, to several stages of the manufacture;

Figure 3 is similar to Figure 2 but represents another stage in the manufacture:

Figure 4 is a plan of a cigarette machine part made according to the invention; and

Figure 5 is an end view of Figure 4.

Referring to Figure 1, 1 is a feed roller of a type used in some industrial machines and has a body 2 of steel and a peripheral covering 3 of refractory material. There is nothing novel in this roller but it has been found that, even with the utmost care in handling, the sharp edges 4 are liable to fracture or crumble away. An object of the invention is to prevent or reduce such breakage.

The steel body is first cleaned by a grit blasting process. This is not illustrated but, where necessary, a set-up similar to that shown in Figure 2 could be used to rotate the work while a grit blasting nozzle is traversed to cover the job, or such parts of it as are deemed necessary.

The body is then heated and coated with nickel by a flash spray, using nickel powder. This step is illustrated in Figure 2 where the work is being rotated between centres 5 and heated by radiant heat from an element. When the work is sufficiently heated a flame sprayer 7 is put into operation and traversed as shown to coat the rim of the roller 1. The surface which is to receive the refractory coating is thus protected against rust.

The roller is then sprayed with a refractory material namely one of those specified later to the thickness required to give a suitable coating to the periphery, the coating being somewhat thicker than that required in the finished article, to allow for grinding or other mechanical sizing and finishing operations. Since the same gun can be used for both coatings Figure 2 may be regarded as representing the refractory coating step, the heater being switched off.

The roller, finished to size, is then coated with the solid epoxy resin specified above. For this purpose the part is warmed and a stick of resin is rubbed over the refractory surfaces. The stage is represented in Figure 3 which is identical with Figure 2 except that a stick of resin 8 is substituted for the gun 7.

Finally the part is heated in a temperature-controlled oven to 200° C. for 40 minutes to cure the resin, but it appears to be unnecessary to illustrate this step.

Referring now to Figure 4 this is a plan view of a steel grooved block 10 known as a garniture block and is a part of a cigarette machine which is subjected to intense wear. An endless tape of fairly coarse fibre runs through the groove being bent into a semi-circle in the small groove 11 and opening out to a flat shape in the run-outs 12. The tape runs continuously at about 300 feet per minute and as tobacco always sheds dust and sand the action on the block is practically continuous lapping. It is important to avoid wear of the small groove as this determines the size and shape of the cigarettes made and what is still more important increase in groove size means increase in weight of the cigarettes. In the past all kinds of expedients have been tried to reduce wear but eventually all makers have reverted to case-hardened steel. In British Patent Specification No. 629,853 there is described a garniture consisting of a metal base with ceramic insets comprising the grooves. That construction was satisfactory as regards wear but it was difficult and rather expensive to make satisfactorily because it involved a series of ceramic blocks which had to be in very accurate alignment. Moreover the abrasive nature of the ceramic material caused the tape to wear faster than was desirable. By coating the rubbing surfaces of the grooves 11 and 12 according to the invention there is achieved a strong metal block with an almost everlasting rubbing face which is nevertheless smooth enough to avoid undue tape wear.

The bonding of a refractory surface as above described reduces the danger of flaking, chipping or crumbling and forms a seal to its otherwise porous surface by filling the pores or spaces between the particles of material which makes the surface extremely smooth and thus greatly reduces its abrasive properties without detriment to its wearing qualities.

Where it is necessary for the sprayed material to be left rough, as sprayed, for use as a hard rough surface, edges, corners and like portions can be bonded, that is treated with the resin to reduce the danger of chipping or crumbling.

In addition to aluminium oxide materials of which there are several kinds there are

zirconium oxides, also sometimes used as mixtures with aluminium oxides and silicon carbide. These comprise "refractory materials" as specified. The nicked powder used may be that known as 43C and sold by the Metallizing Equipment Co. Ltd.

WHAT WE CLAIM IS:—

1. A process for making industrial articles of refractory material as specified consisting in spraying said material on to a metal body and after the surface of the material had undergone any necessary mechanical finishing operations, subjecting the material to a surface treatment by applying the epoxy resin hereinbefore specified to its surface to render the surface smooth and to reinforce the refractory material so as to reduce its liability to chipping or breakage.

2. A process as claimed in Claim 1 for articles having a body of ferrous material, comprising the additional step of coating that part of the body which is to be sprayed with refractory material with another metal not effected by the said material.

3. Industrial articles of refractory material made by the processes claimed in Claim 1 or Claim 2.

4. A garniture block comprising a grooved steel body the grooved parts whereof are coated by the process claimed in Claim 2.

5. Processes of making industrial articles of refractory materials as specified substantially as herein described with reference to the accompanying drawings.

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PROVISIONAL SPECIFICATION.

Improvements in the Manufacture of Ceramic Industrial Articles.

We, FREDERICK DAVID DAVIES, a British Subject, and MOLINS MACHINE COMPANY LIMITED, a British Company, both of 2 Evelyn Street, Deptford, London, S.E.8, England, do hereby declare this invention to be described in the following statement:

This invention concerns improvements in the manufacture of ceramic industrial articles.

Articles made of ceramic material have been used for many years for machine parts where hardness and resistance to wear is desired. Such ceramic articles are made of materials which are basically of an abrasive nature, the principal materials being aluminium oxide (Al_2O_3) but other materials mentioned hereafter are of a similar nature in this respect.

In earlier times these articles were made of powdered ceramic material moulded and bonded together under heat and pressure but while such articles were effective for their purpose they were rather brittle and required properly supporting by elaborate and expensive supports.

In recent years it has been possible to make articles equivalent in their performance to solid ceramic industrial articles by a process of spraying ceramic material on to metal bodies, for example, steel bodies, thus producing a composite article. This process provides strong and satisfactory articles suitable for instance for spindles, bushes and guides, but although the surfaces can be worked to a great degree of perfection they are, nevertheless, as stated, fundamentally abrasive. Moreover, with the sprayed articles there is a marked tendency for the ceramic to chip or break away at corners or places where it is liable to shock.

It is an object of the invention to provide such articles, hereafter called "ceramic industrial articles of the kind referred to", which have a less abrasive surface and in which the tendency to chipping or breaking is substantially reduced.

According to the invention ceramic industrial articles of the kind referred to are made by spraying ceramic material on to a metal body and after the surface of the ceramic has undergone any necessary finishing operations it is subjected to a surface treatment by applying an epoxy resin to its surface, such resins being chosen to produce the desired results, namely, to render the surface smooth, and/or to reinforce the ceramic material so as to reduce its liability to chipping or breakage. A suitable resin is specified later.

Where the body is of a metal which is liable to decay in the presence of a sprayed ceramic, for example, ferrous bodies rust, the metal may be plated or coated in any known way with a metal which is immune from such decay.

For ferrous bodies a nickel coat is suitable and conveniently this is sprayed on, because the same gun can be used for spraying the ceramic, and the general conditions and requirements, e.g. spraying booths, safety measures and so on are similar.

The invention will be further described with reference to the manufacture of an article by the spraying process where the

ceramic is sprayed on to a body of steel or other ferrous metal. The body is first cleaned by a grit blasting process and is then heated. It is then coated with nickel by a flash spray with nickel powder and thereafter is sprayed in the usual way with a ceramic material to the thickness required. This thickness will, of course, depend on whether the article is to be ground to a fine finish, or to be left rough as related later.

When the article has been prepared in this way it is warmed and the ceramic surface is treated with an epoxy resin known as Araldite (R.T.M.) Type 1 to form a bond which fills the spaces between the particles of the ceramic material. This is easily done by rubbing a stick of the resin over the coated surface of the article which is first warmed. The coated article is then heated in a temperature controlled oven at 200° C. for 40 minutes to cure the resin.

The bonding of the ceramic surface reduces the danger of flaking, chipping or crumbling and forms a seal to its otherwise porous surface by filling the pores or spaces between the particles of ceramic material which makes the surface extremely smooth and thus greatly reduces its abrasive properties without detriment to its wearing qualities.

Where it is necessary for the sprayed material to be left rough, as sprayed for use as a hard rough surface, edges, corners and like portions can be bonded, that is, treated with the resin to reduce the danger of chipping or crumbling.

In addition to aluminium oxide materials of which there are several kinds there are zirconium oxides, also sometimes used as mixtures with aluminium oxides and silicon carbide. In short any known ceramic material which is hard enough to be used as an abrasive and may be sprayed on to a metal body is included. The nickel powder used may be that known as 43 C and sold by the Metallizing Equipment Co. Ltd.

British Patent Specification No. 629,853 describes and claims a portion of a continuous rod cigarette-making machine known as a garniture and said portion is constructed of solid ceramic material fixed to and supported by steel members. The present invention includes a garniture of equivalent nature but made by the processes set out in this Specification.

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885,485 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

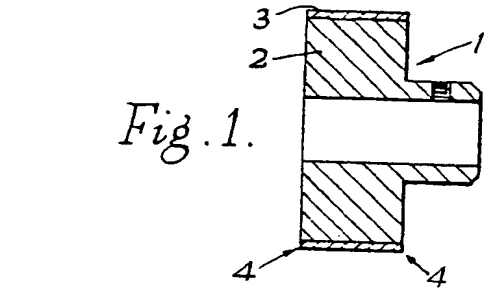

Fig. 1.

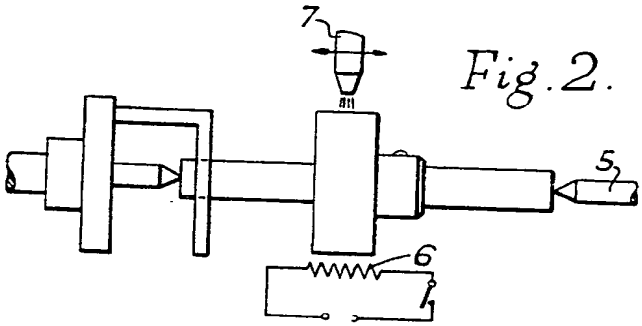

Fig. 2.

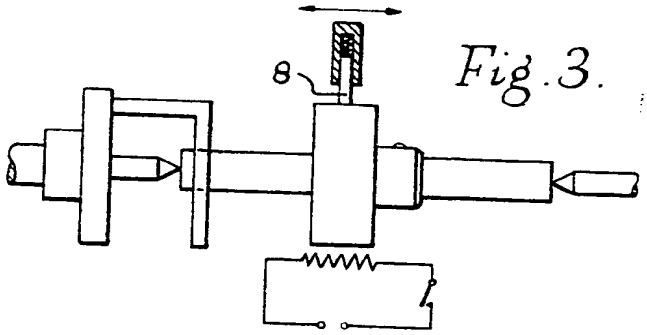

Fig. 3.

Fig. 4.

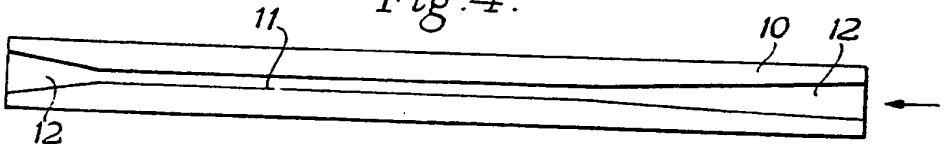

Fig. 5.